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Review

# Globalization and bank efficiency nexus: Symbiosis or parasites?

Fadzlan Sufian [a,*], Muzafar Shah Habibullah [b,1]

[a] *Institute of Islamic Banking and Finance, International Islamic University Malaysia, 205A Jalan Damansara, Damansara Heights, 50480 Kuala Lumpur, Malaysia*

[b] *Department of Economics, Faculty of Economics and Management, Universiti Putra Malaysia, 43400 Serdang, Selangor Darul Ehsan, Malaysia*

**Abstract**

The performance of the banking sector is a subject that has received academic and policymaker attention in recent years. The rapid pace of the financial sector liberalization further accentuates policymakers' interest in the topic. To date, studies examining the performance of the Asian banking sectors are numerous. However, these studies have mainly concentrated on the impacts of banking sector restructuring and bank ownership issues, while empirical evidence on the impact of economic globalization is completely missing from the literature. In light of the knowledge gap, this study provides, for the first time, empirical evidence on the nexus between the level of globalization and the performance of the Indonesian banking sector during the period from 1999 to 2007.

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## 1. Introduction

The importance of banks is premised on the fact that banks are the main channels of savings and allocations of credit in an economy. If the banking sector is efficient, then it should show profitability improvements, increasing the volume of funds flowing from savers to borrowers and improving the quality of services for consumers. Unlike in developed countries where financial markets as well as the banking system works in unison to channel those funds, in developing countries, financial markets are undersized and sometimes completely absent. Thus, it falls on the banking sector to bridge the gap between savers and borrowers and to perform all tasks associated with the profitable and secure channeling of funds. The banking sector also plays an important economic role in providing financial intermediation and economic acceleration by converting deposits into productive investments. These attributes entail the study of banking sector performance in developing economies of greater significance.

The banking sector is the backbone of the Indonesian economy and plays an important financial intermediary role. Therefore, their health is critical to the health of the economy at large. Furthermore, the relationship between the well-being of the banking sector and the growth of the economy has been widely documented in the literature (e.g., Rajan and Zingales, 1998; Levine, 1998; Levine and Zervos, 1998; Cetorelli and Gambera, 2001; Beck and Levine, 2004). These factors entail the knowledge of the underlying factors that influence the performance of the banking sector of interest to the managers of the banks, the central bank, bankers associations, governments, and other financial authorities. Knowledge of these factors would also be helpful for the regulatory authorities and bank managers going forward as they formulate policies for the Indonesian banking sector.

The purpose of the present paper is to extend the earlier works on the performance of the banking sector in a developing economy and to establish empirical evidence on the impact of economic globalization. The paper also investigates to what extent the performance of banks is influenced by internal

* Corresponding author. Tel.: +60 3 2082 2820; fax: +60 3 2094 7728.
*E-mail addresses:* fadzlans@iium.edu.my, fadzlan.sufian@gmail.com (F. Sufian), muzafar@econ.upm.edu.my (M.S. Habibullah).
[1] Tel.: +60 3 8946 7744.

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factors (i.e., bank specific characteristics) and by external factors (i.e., macroeconomic conditions, financial markets conditions, and economic globalization). Although empirical evidence that examines the performance of banking sectors is abundant in the literature, to the best of our knowledge, virtually nothing has been published to address the impact of economic globalization on the efficiency of the banking sector. In light of the knowledge gap, this study provides, for the first time, empirical evidence on the impact of economic globalization on the performance of the banking sector. Below, we differentiate this paper from previous ones that focus on the banking sectors of developing countries in general and the Indonesian banking sector in particular and add insights in several respects.

First, although there exists several studies that examine the performance of the Indonesian banking sector, these studies have been published in Indonesian scholarly journals, while only a few studies are available to non-Indonesian readers. The present study attempts to fill this gap in the literature by providing the most recent evidence on the performance of the Indonesian banking sector.

Second, unlike the previous studies performed to investigate the efficiency of the Indonesian banking sector, the present study constructs and analyzes the results derived from dynamic panels, which is critical in a dynamic business environment as a bank may be highly efficient in one year but may not be efficient in the following year(s). A dynamic panel analysis may also highlight any significant changes taking place in the Indonesian banking sector during the period under study.

Finally, although a number of studies have examined the impact of economic globalization (e.g., Heinemann, 2000; Mah, 2002; Yusuf, 2003; Agénor, 2004; Srinivasan and Wallack, 2004; Dreher, 2006; Dreher and Gaston, 2007; Dreher and Gaston, 2008; Dreher et al., 2008a,b; Arribas et al., 2009; Patti and Navarra, 2009), these studies have typically assessed the influence of economic globalization on the well-being of the general economy. On the other hand, studies examining the relationship between economic globalization and the performance of the banking sector are completely missing from the literature.

To do so, we employ the non-parametric frontier-based Data Envelopment Analysis (DEA) method to estimate the efficiency of the Indonesian banking sector during the post-Asian financial crisis period from 1999 to 2007. The method allows us to distinguish between three different types of efficiency measures, namely, technical, pure technical, and scale. Following the more recent approach suggested by Banker et al. (2010), Hsiao et al. (2010), Chang et al. (2009), and Banker and Natarajan (2005) among others, we also use the central tendency and parametric method that are involved in fixed effects Panel Regression Analysis to investigate the Indonesian banking sector's production efficiency, while controlling for the potential effects of the contextual variables (i.e., internal and external determinants). In this way, we protect against the 'methodological bias' that can occur when only one method is used (see the exchange between Evans and Heckman, 1988 and Charnes et al., 1988). Although this approach has been used in some of the earlier studies, in our case, we examine a more recent period that follows the changes outlined above.

This paper proceeds as follows. In the next section, we provide reviews of the main literature. In Section 3, we outline the approaches to the measurement of efficiency change and the econometric framework. Section 4 discusses the results, and we conclude in Section 5.

## 2. Review of the literatures

The literature examining the efficiency of financial institutions with parametric and/or non-parametric frontier techniques has expanded rapidly in recent times. While a large body of literature spanning a half-century exists on banking efficiency in the U.S. (see surveys in Berger et al., 1993; Berger and Humphrey, 1997; Berger, 2007 and references therein), more recent studies examine several other countries such as Turkey (Isik and Hassan, 2002; Isik and Hassan, 2003), Hong Kong (Drake et al., 2006), Greece (Pasiouras, 2008), Malaysia (Sufian, 2009), Korea (Sufian and Habibullah, 2009), etc.

Apart from focusing on various countries, these studies also examine several other issues of bank efficiency, such as the impact of risk on bank efficiency (e.g., Drake and Hall, 2003), the impact of off-balance sheet activities on bank efficiency (e.g., Lozano-Vivas and Pasiouras, 2010), the relationship between bank efficiency and share prices (e.g., Pasiouras et al., 2008), and the impact of mergers on bank efficiency (e.g., Al-Sharkas et al., 2008). The comparison of efficiency between foreign and domestic banks has also been studied extensively. Generally, the empirical evidence shows that foreign banks in developing and transition countries have succeeded in capitalizing on their advantages and exhibit a higher level of efficiency than their domestic bank peers (Bhattacharyya et al., 1997; Isik and Hassan, 2002; Ataullah and Le, 2006; Havrylchyk, 2006).

Single country studies focusing on the Asian banking sectors have mainly examined the impact of different ownership forms on bank performance. Generally, the empirical evidence shows that foreign banks have succeeded in capitalizing on their advantages and exhibit a higher level of efficiency than their domestic bank peers. Leightner and Lovell (1998) find that the average Thai bank experienced falling total factor productivity growth (TFP), while the average foreign bank experienced increasing TFP. In a study on the banking sector of the Philippines, Unite and Sullivan (2003) suggest that the entry of foreign banks in the Philippines has resulted in the reduction of interest rate spreads and profits of the domestic banks, particularly those that are affiliated with family business groups.

The South Asian banking sectors have also been studied extensively. Sathye (2003) and Shanmugam and Das (2004) find that the public and foreign owned banks in India have exhibited a higher level of technical efficiency compared to their privately owned bank peers. Iimi (2004) suggests that privatized banks in Pakistan are the most efficient, followed by the foreign owned banks, while the public banks have been the least efficient. Hardy and di Patti (2001) investigate the effects of financial reforms on profitability, cost, and revenue efficiency of the Pakistan banking sector between 1981 and 1998. They show that financial

liberalization has a positive impact on bank performance. Subsequently, di Patti and Hardy (2005) examine the cost and profit efficiency of Pakistan's commercial banks between 1981 and 2002 and find that financial liberalization leads to higher bank profitability, but only during the first round of financial reform in 1991–1992.

Despite substantial studies performed in regard to the efficiency of financial institutions in the U.S., Europe, and other Asia-Pacific banking industries, empirical evidence on the Indonesian banking sector is relatively scarce. As previously mentioned, although there have been a number of studies examining the efficiency of the Indonesian banking sector, these studies have been published in Indonesian scholarly journals.[2] To date, only a few studies are available to non-Indonesian readers. Among them are studies by Harada and Ito (2005), Omar et al. (2007), and Margono et al. (2010).

Harada and Ito (2005) employ the DEA method to examine the efficiency of the Indonesian banking sector during the post-Asian financial crisis period. The empirical findings suggest that the efficiency of the Indonesian banking sector has improved gradually since the Asian financial crisis in 1997 and 1998. They also suggest that privatization of the state owned banks has not always resulted in better performance and market valuations. By employing the DEA and the Malmquist Productivity Index (MPI) methods, Omar et al. (2007) investigate the efficiency and productivity of 21 national private banks operating in the Indonesian banking sector during the period 2002–2004. The empirical findings suggest that technical change outweighs efficiency change in influencing the Indonesian bank total factor productivity growth. More recently, Margono et al. (2010) examines the cost efficiency, economies of scale, technological progress, and productivity growth of the Indonesian banking sector during the period from 1993 to 2000 and find that the Indonesian banking sector has exhibited an average technical efficiency of 80% during the pre-crisis period, while the efficiency level is observed to be considerably lower during the post-Asian financial crisis period.

The above literature reveals the following research gaps. First, the majority of these studies concentrate on the banking sectors of the developed countries, such as the U.S. and countries in Europe. Second, empirical evidence on developing and emerging countries is relatively scarce. Finally, apart from the few studies discussed above, virtually nothing has been published to examine the impact of economic globalization on bank efficiency. In light of these knowledge gaps, this paper seeks to provide new empirical evidence on the impact of economic globalization on the efficiency of the Indonesian banking sector.

[2] For example, Hadad et al. (2003a), Abidin and Cabanda (2007), and Putri and Niki (2008) employ the non-parametric Data Envelopment Analysis (DEA), while Hadad et al. (2003b) employ the parametric Stochastic Frontier Approach (SFA) method.

## 3. Methodology and data

### 3.1. Data Envelopment Analysis

The present study employs the DEA method, first introduced by Charnes et al. (1978) using the CCR model, to estimate the input-oriented technical efficiency of the Indonesian banking sector. The DEA method involves constructing a non-parametric production frontier based on the actual input–output observations in the sample relative to which efficiency of each bank in the sample is measured (Coelli, 1996). This approach measures the efficiency of a decision-making unit (DMU) relative to similar DMUs with the simple restriction that all DMUs lay on or below the efficiency frontier. If a DMU lies on the frontier, it is referred to as an efficient unit. Otherwise, the DMU is labeled as inefficient. The data are enveloped in such a way that radial distances to the frontier are minimized.

The CCR model can be formulated as follows:

$$\begin{aligned} \min \quad & l_0 - \varepsilon \left[ \sum_{i=1}^{m} S_i^- + \sum_{r=1}^{s} S_r^+ \right] \\ \text{subject to :} \quad & \sum_{f=1}^{N} \lambda_f x_{if} = l_0 x_{if0} - S_i^- \qquad \text{where} \quad i = 1 \ldots m \\ & \sum_{f=1}^{N} \lambda_f y_{rf} = S_r^+ + y_{rf0} \qquad \text{where} \quad r = 1 \ldots s \\ & \lambda_f \geq 0, \quad f = 1 \ldots N, \quad S_i^-, S_r^+ \geq 0 \quad \forall i \text{ and } r \end{aligned} \tag{1}$$

where $x_{if}$ and $y_{rf}$ are levels of the $i$th input and $r$th output, respectively, for DMU $f_0$. $N$ is the number of DMUs. $\varepsilon$ is a very small positive number (non-Archimedean) used as a lower bound to inputs and outputs. $\lambda_f$ denotes the contribution of DMU $f$ in deriving the efficiency of the rated DMU $f_0$ (a point at the envelopment surface). $S_i^-$ and $S_r^+$ are slack variables to proxy extra savings in input $i$ and extra gains in output $r$. $l_0$ is the radial efficiency factor that shows the possible reduction of inputs for DMU $f_0$. If $l_0^*$ (optimal solution) is equal to one and the slack values are both equal to zero, then DMU $f_0$ is said to be efficient. When $S_i^-$ or $S_r^+$ takes a positive value at the optimal solution, one can conclude that the corresponding input or output of DMU $f_0$ can improve further once input levels have been contracted to the proportion $l_0^*$.

The CCR model presupposes that there is no significant relationship between the scale of operations and efficiency by assuming constant returns to scale (CRS), and thus, it delivers the overall technical efficiency (TE). The CRS assumption is only justifiable when all DMUs operate at an optimal scale. However, banks, in practice, may face either economies or diseconomies of scale. Thus, if one makes the CRS assumption when not all DMUs are operating at the optimal scale, the computed measures of TE will be contaminated by scale efficiency (SE).

Banker et al. (1984) extended the CCR model by relaxing the CRS assumption. The resulting BCC model is used to assess the efficiency of DMUs characterized by variable returns to scale (VRS). The VRS assumption provides the measurement of pure technical efficiency (PTE), which is the measurement of TE devoid of the SE effects. If there appears to be a difference

between the TE and PTE scores of a particular DMU, then it indicates the existence of scale inefficiency, i.e., TE = PTE × SE. The former relates to the capability of managers to utilize banks' given resources, whereas the latter refers to exploiting scale economies by operating at a point where the production frontier exhibits CRS.

The input oriented BCC model with VRS assumption can be represented by the following linear programming problem:

$$\begin{aligned} \min \quad & l_0 - \varepsilon \left[ \sum_{i=1}^{m} S_i^- + \sum_{r=1}^{s} S_r^+ \right] \\ \text{subject to :} \quad & \sum_{f=1}^{N} \lambda_f x_{if} = l_0 x_{if0} - S_i^- \qquad \text{where} \quad i = 1 \ldots m \\ & \sum_{f=1}^{N} \lambda_f = 1 \qquad \text{where} \quad r = 1 \ldots s \\ & \lambda_f \geq 0, \quad f = 1 \ldots N, \quad S_i^-, S_r^+ \geq 0 \quad \forall i \text{ and } r \end{aligned} \tag{2}$$

The BCC model differs from the CCR model in that it includes the so-called convexity constraint, $\sum_{f=1}^{N} \lambda_f = 1$, which prevents any interpolation point constructed from the observed DMUs from being scaled up or down to form a referent point. In this model, the set of λ values minimizes $l_0$ to $l_0^*$ and identifies a point within the VRS assumption of which the input levels reflect the lowest proportion of $l_0^*$. At $l_0^*$, the input levels of DMU $f_0$ can be uniformly contracted without having any detrimental impact on the output levels. Therefore, DMU $f_0$ has efficiency equal to $l_o^*$. The solution to model (2) is summarized in the following fashion: DMU $f_0$ is pareto-efficient if $l_0^* = 1$ and $S_r^{+*} = 0, \quad r = 1 \ldots s, S_i^{-*} = 0, i \ldots m$.

If the convexity constraint in Eq. (2) is dropped, one obtains Eq. (1), which generates technical efficiency under the CRS assumption. This implies that the PTE of a DMU is always greater or equal to its TE. Under the VRS assumption, the resulting SE can be measured, as in most cases, the scale of operation of the firm may not be optimal. The firm involved may be too small in its scale of operation, which could fall within the increasing returns to scale part of the production function. Similarly, a firm may be too large and operate within the decreasing returns to scale part of the production function. In both cases, efficiency of the firms may be improved by changing their scale of operation. If the underlying production technology follows the CRS, then the firm is automatically scale efficient. The resulting ratio illustrates SE, which is the impact of scale size on the efficiency of a DMU. Formally, the SE of DMU $f_0$ is given as TE/PTE, where TE and PTE are technical efficiency and pure technical efficiency of DMU $f_0$, respectively.

As the PTE is always greater or equal to the TE, it means that SE (TE/PTE) is less or equal to unity. If the TE and PTE of a DMU are equal, then SE is equal to one. This means that irrespective of scale, size has no impact on efficiency. If the TE scores derived from the CRS assumption are less than the TE scores derived from the VRS assumption, then SE will be below unity, meaning that the scale of operation influences the efficiency of the DMUs.

### 3.2. Multivariate Panel Regression Analysis

It is of considerable interest to explain the determinants of the technical efficiency scores derived from the DEA model. Coelli et al. (1998) suggest several ways in which environmental variables can be accommodated in a DEA analysis. The term "environmental variables" is usually used to describe factors that could influence the efficiency of a firm. In this case, such factors are not traditional inputs and are assumed to be outside the control of the manager. Hence, the two-stage method used in the present study involves the solution of the DEA problem in the first stage analysis, which comprises mainly the traditional outputs and inputs. In the second stage, the efficiency scores obtained from the first stage analysis are regressed on a set of bank characteristics.

In an influential development, Banker and Natarajan (2008) provide proof that the use of a two-stage procedure involving the DEA followed by an Ordinary Least Squares (OLS) regression yields consistent estimators of the regression coefficients. Furthermore, in an important development, McDonald (2009) provides statistical foundation that the use of DEA and OLS is a consistent estimator, and if White's (1980) heteroskedastic consistent standard errors are calculated, large sample tests can be performed that are robust to heteroskedasticity and the distribution of the disturbances. Thus, following, among others, Banker et al. (2010), Hsiao et al. (2010), Chang et al. (2009), and Banker and Natarajan (2005), the second stage regressions in the present study are estimated by using the OLS method, while the standard errors are calculated by using White's (1980) cross-section tests to adjust for cross-section heteroskedasticity.

As a robustness check, Eq. (3) is also re-estimated by using the least square method of the fixed effects model (FEM). The opportunity to use a fixed effects rather than a random effects model has been tested with the Hausman test. As suggested by McDonald (2009), we estimate Eq. (3) by using White's (1980) transformation, which is robust to heteroskedasticity, and the distribution of the disturbances in the second stage regression analysis involving DEA scores as the dependent variable.

$$\begin{aligned} \ln(TE)_{i,t} = \quad & \alpha + \beta_1 \ln(\text{LOANS/TA})_{i,t} + \beta_2 \ln(\text{TA})_{i,t} + \beta_3 \ln(\text{LLP/TL})_{i,t} \\ & + \beta_4 \ln(\text{NII/TA})_{i,t} + \beta_5 \ln(\text{NIE/TA})_{i,t} + \beta_6 \ln(\text{EQASS})_{i,t} + \beta_7 \ln(\text{ROA})_{i,t} \\ & + \zeta_1 \ln(\text{GDP})_t + \zeta_2 \ln(\text{INFL})_t + \zeta_3 \ln(\text{CR3})_t \\ & + \zeta_4 \ln(\text{MKTCAP/GDP})_t + \zeta_5 \ln(\text{Z-SCORE})_t \\ & + \delta_1 \text{ACT\_FLOW}_t + \delta_2 \text{RESTRICT}_t + \delta_3 \text{PERS\_CONT}_t \\ & + \delta_4 \text{INFO\_FLOW}_t + \delta_5 \text{CUL\_PROX}_t + \delta_6 \text{POLITICS}_t + \varepsilon_{it} \end{aligned} \tag{3}$$

$$\varepsilon_{i,t} = \nu_{i,t} + \mu_{i,t}$$

Table 1
Descriptive statistics for inputs and outputs.

| | Loans (Y1) | Investments (Y2) | Off-Balance Sheet (Y3) | Total Deposits (X1) | Fixed Assets (X2) | Non-Interest Expense (X3) |
|---|---|---|---|---|---|---|
| Min | 19,418.20 | 11,365.18 | 4689.80 | 29,735.18 | 653.89 | 1287.03 |
| Mean | 8.90 | 0.59 | 4.90 | 4.80 | 0.16 | 4.58 |
| Max | 240,301.65 | 92,627.37 | 53,148.77 | 289,112.10 | 5483.63 | 17,351.46 |
| S.D. | 39,490.95 | 19,079.47 | 8799.52 | 50,698.13 | 1055.20 | 2274.46 |

Banks annual reports and authors own calculations.
*Note*: Y1: Loans (includes loans to customers and other banks); Y2: Investments (includes dealing and investment securities); Y3: Off-Balance Sheet Commitments; X1: Total Deposits (includes deposits from customers and other banks); X2: Net Fixed Assets (measured by the book value of property, plant, and equipment); X34: Non-Interest Expense.

where '*i*' denotes the bank, '*t*' the examined time period, and $\varepsilon$ is the disturbance term, with $v_{it}$ capturing the unobserved bank-specific effect and $u_{it}$ denoting the idiosyncratic error as it is independently identically distributed (i.i.d.), $e_{it} \sim N(0, \sigma^2)$. Following De Bandt and Davis (2000) and Staikouras et al. (2008), among others, the log-linear form is chosen as it typically improves the regression's goodness of fit and may reduce simultaneity bias.

### 3.3. Specification of bank inputs, outputs, and data

The definition and measurement of inputs and outputs in the banking function remains a contentious issue among researchers. In the banking theory literature, there are two main approaches competing with each other in this regard – the production and the intermediation approaches (Sealey and Lindley, 1977). Under the production approach, pioneered by Benston (1965), a financial institution is defined as a producer of services for account holders, that is, they perform transactions on deposit accounts and process documents, such as loans. The intermediation approach, on the other hand, assumes that financial firms act as intermediaries between savers and borrowers and posits total loans and securities as outputs, while deposits, along with labor and physical capital, are defined as inputs.

With regard to the definition of inputs and outputs, for the purpose of this study, we adopt a variation of the intermediation approach or asset approach originally developed by Sealey and Lindley (1977). According to Berger and Humphrey (1997), the production approach is more suitable for branch efficiency given that, at most times, bank branches process customer documents, and bank funding, while most investment decisions are not under the control of branches.

Accordingly, we model Indonesian banks as multi-product firms that produce three outputs by employing two inputs. All variables are measured in millions of Indonesian rupiah (IDR). The input vectors are ($x1$) Total Deposits, which includes deposits from customers and other banks and ($x2$) Fixed Assets, while ($y1$) Total Loans, which includes loans to customers and other banks and ($y2$) Investments are the output vectors. To recognize that financial institutions in recent years have increasingly been generating income from non-traditional business and fee income, ($y3$) Off-Balance Sheet Item is included in the study as a proxy of non-traditional activities as an additional output variable. The summary statistics of the input and output variables employed in the DEA method are given in Table 1.

We use the annual bank level and macroeconomic data of Indonesian commercial banks over the period 1999–2007. The variables are obtained from balance sheet information published in annual reports of each individual bank. Due to missing observations for some banks for certain years, the present paper employs an unbalanced panel of 33 banks, which accounts for more than 70% of the Indonesian banking sector's total assets. This gives us a total of 269 bank-year observations. We retrieve the economic globalization index from the 2010 KOF Index of Globalization developed by Dreher (2006) and updated in Dreher et al. (2008b). The macroeconomic variables are retrieved from the IMF Financial Statistics (IFS) and World Bank World Development Indicators (WDI) databases. Table 2 presents the descriptions, summary statistics, and sources of variables used to proxy efficiency and its determinants.

Seven independent variables that are widely followed by policymakers and practitioners are examined. Liquidity risk arising from the possible inability of banks to accommodate decreases in liabilities or to fund increases on the asset side of the balance sheet is considered an important determinant of bank performance. The loans market, especially credit to households and firms, is risky and has greater expected return than other bank assets, such as government securities. Thus, one would expect a positive relationship between liquidity (LOANS/TA) and bank performance (Bourke, 1989). Furthermore, Eichengreen and Gibson (2001) suggest that one should expect higher profitability levels for banks with lower amounts of funds tied up in liquid investments.

The LNTA variable is included in the regression models as a proxy of size to capture the possible cost advantages associated with size (economies of scale). This variable controls for cost differences and product and risk diversification according to the size of the bank. The first factor could lead to a positive relationship between size and bank performance if there are significant economies of scale (Akhavein et al., 1997; Bourke, 1989; Molyneux and Thornton, 1992; Bikker and Hu, 2002; Goddard et al., 2004), while the second factor could result in a negative relationship if increased diversification leads to lower credit risk and, thus, lower returns. Other researchers however conclude that marginal cost savings can be achieved by increasing the size of the banking firm, especially as markets develop (Berger et al., 1987; Boyd and Runkle, 1993; Miller

Table 2
Descriptive of the variables used in the regression models.

| Variable | Description | Mean | S.D. | Sources/database |
|---|---|---|---|---|
| Dependent | | | | |
| TE | Technical efficiency of the bank in year *t* derived from the DEA method. | −0.222 | 0.289 | – |
| Independent | | | | |
| Bank specific factors | | | | |
| LOANS/TA | A measure of liquidity, calculated as total loans/total assets. The ratio indicates what percentage of the assets of the bank is tied up in loans in year *t*. | 3.743 | 0.535 | BankScope |
| LNTA | The natural logarithm of the accounting value of the total assets of the bank in year *t*. | 9.104 | 1.902 | BankScope |
| LLP/TL | Loan loss provisions/total loans. An indicator of credit risk, which shows how much a bank is provisioning in year *t* relative to its total loans. | 3.152 | 0.299 | BankScope |
| NII/TA | A measure of diversification and business mix, calculated as non-interest income/total assets. | −3.607 | 1.796 | BankScope |
| NIE/TA | Calculated as non-interest expense/total assets and provides information on the efficiency of the management regarding expenses relative to the assets in year *t*. Higher ratios imply a less efficient management. | −3.432 | 0.533 | BankScope |
| EQASS | A measure of bank's capital strength in year *t*, calculated as equity/total assets. High capital asset ratio is assumed to be indicator of low leverage and therefore lower risk. | 4.924 | 0.238 | BankScope |
| ROA | The return on average total assets of the bank in year *t*. | 4.301 | 0.261 | BankScope |
| Macroeconomic and industry specific factors | | | | |
| LNGDP | Natural logarithm of gross domestic products. | 5.549 | 0.399 | IMF International Financial Statistics |
| INFL | The rate of inflation. | 2.012 | 0.572 | IMF International Financial Statistics |
| CR3 | The three largest banks asset concentration ratio. | 0.566 | 0.071 | IMF International Financial Statistics |
| MKTCAP/GDP | The ratio of stock market capitalization. The variable serves as a proxy of financial development. | 0.255 | 0.081 | IMF International Financial Statistics |
| Z-SCORE | The Z-Score index. Is used as a proxy measure of the banking sector's risk to default. | 5.955 | 2.412 | IMF International Financial Statistics |
| Economic globalization | | | | |
| ACT_FLOW | The actual flow index. | 56.031 | 6.002 | Dreher (2006) |
| RESTRICT | The restrictions index. | 65.517 | 6.977 | Dreher (2006) |
| PERS_CONT | The personal contact index. | 15.255 | 1.048 | Dreher (2006) |
| INFO_FLOW | The information flow index. | 47.679 | 2.208 | Dreher (2006) |
| CUL_PROX | The cultural proximity index. | 32.216 | 0.460 | Dreher (2006) |
| POLITICS | The political globalization index. | 82.128 | 1.866 | Dreher (2006) |

and Noulas, 1997; Athanasoglou et al., 2008). In essence, LNTA may lead to positive effects on bank performance if there are significant economies of scale. On the other hand, if increased diversification leads to higher risks, the variable may exhibit negative effects.

The ratio of loan loss provisions to total loans (LLP/TL) is incorporated as an independent variable in the regression analysis as a proxy of credit risk. The coefficient of LLP/TL is expected to be negative because bad loans tend to exert regressive impact on bank profitability. In this direction, Miller and Noulas (1997) suggest that the greater the exposure of the financial institutions to high risk loans, the higher the accumulation of unpaid loans and, as a result, profitability would also be lower. Miller and Noulas (1997) suggest that a decline in loan loss provisions are in many instances the primary catalyst for increases in profit margins. Furthermore, Thakor (1987) notes that the level of loan loss provisions is an indication of the bank's asset quality, and as such, it signals changes in the future performance.

To recognize that financial institutions in recent years have increasingly been generating income from "off-balance sheet" business and fee income, the ratio of non-interest income over total assets (NII/TA) is entered in the regression models as a proxy for non-traditional activities. Non-interest income consists of commissions, service charges, fees, guarantee fees, net profits from sale of investment securities, and foreign exchange profits. The NII/TA variable is expected to exhibit a positive relationship with bank performance.

The ratio of non-interest expenses to total assets (NIE/TA) is used to provide information on the variations of bank operating costs. The variable represents the total amount of wages and salaries, as well as the costs of running branch office facilities. For the most part, the literature argues that reduced expenses improve the efficiency and, hence, raise the profitability of a financial institution, implying a negative relationship between the operating expense ratio and profitability (Bourke, 1989). However, Molyneux and Thornton (1992) observe a positive relationship, suggesting that high profits earned by banks may be appropriated in the form of higher payroll expenditures paid to more productive human capital.

EQASS is included in the regressions to examine the relationship between efficiency and bank capitalization. Although leverage (capitalization) has been demonstrated to be important in explaining the performance of financial institutions, its impact on bank efficiency is ambiguous. As lower capital ratios suggest a relatively risky position, one may expect a negative coefficient on this variable (Berger, 1995). However, it could be the case that higher levels of equity would decrease the cost of

capital, thus leading to a positive impact on bank performance (Molyneux, 1993). Moreover, an increase in capital may raise expected earnings by reducing the expected costs of financial distress, including bankruptcy (Berger, 1995).

Bank efficiency is sensitive to macroeconomic conditions despite the trend in the industry towards greater geographic diversification and greater use of financial engineering techniques to manage risk associated with business cycle forecasting. Generally, higher economic growth encourages banks to lend more and permits them to charge higher margins, while also improving the quality of their assets. As the GDP growth slows down and, in particular, during recessions, credit quality tends to deteriorate and default rates increase, thus reducing bank profitability. We use the log of gross domestic product (GDP) to control for cyclical output effects, which we expect have a positive influence on bank efficiency. Neely and Wheelock (1997) use per capita income and suggest that this variable exerts a strong positive effect on bank earnings. Demirguc-Kunt and Huizinga (2001) and Bikker and Hu (2002) identify possible cyclical movements in bank performance, i.e., the extent to which bank profits are correlated with the business cycle. Their findings suggest that such correlation exists, although the variables used were not direct measures of the business cycle.

We also account for macroeconomic risk by controlling for the inflation rate (INFL). The extent to which inflation affects bank efficiency depends on whether future movements in inflation are fully anticipated, which, in turn, depends on the ability of banks to accurately forecast their future movements. An inflation rate that is fully anticipated raises profits as banks can appropriately adjust interest rates to increase revenues, while an unanticipated change could raise costs due to imperfect interest rate adjustment (Perry, 1992). The earlier studies by, among others, Bourke (1989), Molyneux and Thornton (1992), Demirguc-Kunt and Huizinga (1999) suggest a positive relationship between inflation and bank performance.

The CR3 variable measured as the concentration ratio of the three largest banks in terms of assets is entered the regression models as a proxy variable for the banking sector concentration. According to the industrial organization literature, a positive impact is expected under both the collusion and efficiency views (Goddard et al., 2001). Following, among others, Demirguc-Kunt and Huizinga (1999), the MKTCAP is introduced in the regression model to reflect the complementarity or substitutability between bank and stock market financing. Demirguc-Kunt and Huizinga (1999) found that stock market capitalization to bank assets is negatively related to bank margins and suggested that the relatively well developed stock markets can substitute for bank finance. We, therefore, expect the variable to be negatively related to bank performance.

The Z-score (Z-SCORE) variable is a proxy of bank soundness. The index measures how many standard deviations a bank is away from exhausting its capital base (a distance-to-default measure). The Z-score is a popular measure of soundness because it combines banks' buffers (capital and profits) with the risks they face in a way that is grounded in theory (Čihák et al., 2009). A higher Z-score implies a lower probability of insolvency, thus providing a more direct measure of soundness than, for example, simple leverage measures (Čihák et al., 2009). This index combines, in a single indicator, (i) *profitability*, given by a period average Return on Assets (ROA); *leverage measure*, given by the period average equity-to-asset ratio (K) (equity here is defined as total equity from the balance sheet of a bank); and *return volatility*, given by the period standard deviation of return on assets (Vol.(ROA)), i.e., $Z = \text{ROA} + \text{K/Vol.(ROA)}$ where ROA (profitability) is a period average of return on assets, K (leverage measure) is the period average equity-to-asset ratio, and Vol.(ROA) is the return volatility given by the period standard deviation of return on assets. A higher (lower) Z-SCORE indicates lower (higher) risk (De Nicolo et al., 2003).

In regression model 3, we examine the relationship between *economic globalizatio*n and the efficiency of Indonesian banks. Specifically, we introduce two dimensions of economic globalization measures, namely, *actual flows* (ACT_FLOW) and *restrictions* (RESTRICT). We introduce three dimensions of *social globalization* measures in regression model 4, namely, *personal contact* (PERS_CONT), *information flow* (INFO_FLOW), and *cultural proximity* (CUL_PROX). Finally, we include the measure of *political globalization* (POLITICS) in regression model 4 to assess the impact of political globalization on the efficiency of Indonesian banks. All the indices have 1–100 scales where 100 represents the maximum value. A score of 100 signifies a greater level of globalization. The definitions, components, and weights of all indices are presented in Appendix A.

Table 3 provides information on the degree of correlation between the explanatory variables used in the multivariate regression analysis. The matrix shows that, in most cases, the correlation between the bank specific variables is not strong, suggesting that multicollinearity problems are not severe or non-existent. Kennedy (2008) notes that multicollinearity is a problem when the correlation is above 0.80.

## 4. Empirical findings

In this section, we will discuss the technical efficiency change (TE) of the Indonesian banking sector measured by the DEA method and its decomposition into pure technical efficiency (PTE) and scale efficiency (SE) components. The efficiency of the Indonesian banking sector is first examined by applying the DEA method for each year under investigation. To allow efficiency to vary over time, the efficiency frontiers are constructed for each year by solving the linear programming (LP) problems rather than constructing a single multi-year frontier. To construct and analyze results derived from dynamic panels is critical in a dynamic business environment, as a bank may be highly efficient in one year but may not be efficient in the following year (s). A dynamic panel analysis will also highlight any significant changes taking place in the Indonesian banking sector during the period under study.

Isik and Hassan (2002) noted that the principal advantage of having panel data is the ability to observe each bank more than once over a period of time. The issue is also critical in a continuously changing business environment because the technology of a bank that is most efficient in one period may not be the most

Table 3
Correlation matrix for the explanatory variables.

| Independent variables | LOANS/TA | LNTA | LLP/TL | NII/TA | NIE/TA | EQASS | ROA | LNGDP | INFL | CR3 | MKTCAP/GDP | Z-SCORE |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| LOANS/TA | 1.000 | −0.108 | −0.047 | −0.047 | 0.345** | 0.130* | 0.103 | 0.426** | 0.029 | −0.365** | 0.122 | 0.379** |
| LNTA | | 1.000 | 0.103 | 0.104 | 0.086 | −0.251** | 0.251** | 0.213** | 0.045 | −0.142* | 0.048 | 0.188** |
| LLP/TL | | | 1.000 | 0.292** | 0.093 | −0.128* | −0.232** | −0.171** | −0.133* | −0.189** | 0.035 | −0.173** |
| NII/TA | | | | 1.000 | 0.201** | 0.096 | 0.064 | −0.146* | −0.445** | 0.089 | 0.218** | −0.100 |
| NIE/TA | | | | | 1.000 | 0.121 | 0.059 | 0.262** | −0.076 | −0.261** | 0.085 | 0.210** |
| EQASS | | | | | | 1.000 | 0.395** | 0.236** | −0.040 | −0.209** | 0.066 | 0.205** |
| ROA | | | | | | | 1.000 | 0.314** | 0.045 | −0.367** | −0.056 | 0.311** |
| LNGDP | | | | | | | | 1.000 | 0.031 | −0.735** | 0.373** | 0.096** |
| INFL | | | | | | | | | 1.000 | −0.261** | −0.443** | 0.005 |
| CR3 | | | | | | | | | | 1.000 | 0.100 | −0.633** |
| MKTCAP/GDP | | | | | | | | | | | 1.000 | 0.467** |
| Z-SCORE | | | | | | | | | | | | 1.000 |

The notation used in the table below is defined as follows: LOANS/TA is used as a proxy measure of loans intensity, calculated as total loans divided by total assets; LNTA is a proxy measure of size, calculated as a natural logarithm of total bank assets; LLP/TL is a measure of bank risk calculated as the ratio of total loan loss provisions divided by total loans; NII/TA is a measure of bank diversification towards non interest income, calculated as total non-interest income divided by total assets; NIE/TA is a proxy measure for costs, calculated as non-interest expenses divided by total assets; EQASS is a measure of capitalization, calculated as book value of shareholders equity as a fraction of total assets; LNGDP is natural log of gross domestic products; INFL is the rate of inflation; CR3 is the three largest banks asset concentration ratio; MKTCAP/GDP is the ratio of stock market capitalization; Z-SCORE is used as a proxy measure of the banking sector's risk to default.
*Note*: The table presents the results from Spearman ρ correlation coefficients.
* Significance at 5% level.
** Significant at 1% level.

efficient in another. Furthermore, we alleviate, at least to some extent, the problems related to the lack of random error in DEA by allowing an efficient bank in one period to be inefficient in another, assuming that the errors owing to luck or data problems are not consistent over time (Isik and Hassan, 2002).

### 4.1. Efficiency of the Indonesian banking sector

The summary results of technical, pure technical, and scale efficiency estimates are presented in Table 4. It can be observed from Panel A of Table 4 that the mean TE of the Indonesian banking sector ranges between a low of 67.1% in the year 2000 to a high of 94.9% in the year 2007. The empirical findings seem to suggest that relative to their cost frontier, the Indonesian banking sector has been operating with actual costs ranging from a low of 5.1% to 32.9% above the minimum cost levels. As to the TE in each year, we find that it was 81.3% in 1999, that it declined to 67.1% and 66.8% in 2000 and 2001, respectively, and then increased gradually beginning in the year 2002 and onward.

The decomposition of TE into its mutually exhaustive components of PTE and SE reveals that scale inefficiency has greater influence than pure technical inefficiency as a source of inefficiency within all inefficient banks. As can be observed in Table 4, the Indonesian banking sector has exhibited a higher mean PTE in six out of the nine years covered, with an average PTE of 91.7%. On the other hand, the empirical findings presented in Table 4 also indicate that the mean estimates of SE are higher during the years 1999, 2004, 2005, and 2006 with an overall mean SE of 88.4%. In all, the results from the DEA method seem to suggest that, in the case of the Indonesian banking sector, technical inefficiencies have much more to do with the scale of production, rather than the inefficient use of resources due to managerial best practice.

Banks of different sizes may exhibit different operational characteristics. Accordingly, we divide banks in the sample into five major groups according to their total asset size. By doing so, we expect to be able to explore the relationship between the size of the banks and the obtained efficiency levels. Panels B to F present the results. The results clearly indicate that banks in the largest banking group (asset size of <200m) have been the most efficient, followed by banks in the smallest banking group (asset size of >10m). On the other hand, the empirical findings seem to suggest that banks with total assets ranging between 100m and 200m have been the least efficient. The results from this study corroborate the earlier findings by, among others, Berger et al. (1993). Briefly, Berger et al. (1993) suggests that the larger banks tend to report higher levels of technical or X-efficiency compared to their smaller bank peers.

It is also clear from Table 4 that the largest banking group (asset size of <200m) exhibited the highest pure technical efficiency levels, while banks in the smallest banking group (asset size of >10m) have been the least efficient under the pure technical efficiency measure. On the other hand, the empirical findings seem to suggest that the smallest banking group has been the most efficient in terms of scale efficiency, while banks with total assets ranging between 100m and 200m have been the least efficient of the banking groups. The finding is inconsistent with earlier studies by, among others, Humphrey (1990), Berger et al. (1993), and Mester (1997). In essence, the findings from these studies show that the small- and medium-sized banks have been more scale efficient than their large bank counterparts.

The dominant effect of scale inefficiency indicates that banks operating in the Indonesian banking sector have been operating at the 'incorrect' scale of operations. The findings imply that these banks have either experienced economies of scale (i.e., increasing returns to scale (IRS)) due to being at less

Table 4
The decomposition of efficiency change of Indonesian banks.

| Indices | | | |
|---|---|---|---|
| Banks | Technical efficiency (TE) | Pure technical efficiency (PTE) | Scale efficiency (SE) |
| Panel A: All banks | | | |
| 1999 | 0.813 | 0.883 | 0.918 |
| 2000 | 0.671 | 0.889 | 0.750 |
| 2001 | 0.668 | 0.897 | 0.754 |
| 2002 | 0.742 | 0.883 | 0.843 |
| 2003 | 0.774 | 0.908 | 0.860 |
| 2004 | 0.865 | 0.929 | 0.930 |
| 2005 | 0.898 | 0.924 | 0.971 |
| 2006 | 0.927 | 0.962 | 0.964 |
| 2007 | 0.949 | 0.978 | 0.970 |
| Mean | 0.812 | 0.917 | 0.884 |
| S.D. | 0.106 | 0.034 | 0.088 |
| Panel B: Total assets < 200m | | | |
| 1999 | 1.000 | 1.000 | 1.000 |
| 2000 | 0.505 | 1.000 | 0.505 |
| 2001 | 0.662 | 1.000 | 0.662 |
| 2002 | 1.000 | 1.000 | 1.000 |
| 2003 | 1.000 | 1.000 | 1.000 |
| 2004 | 1.000 | 1.000 | 1.000 |
| 2005 | 1.000 | 1.000 | 1.000 |
| 2006 | 1.000 | 1.000 | 1.000 |
| 2007 | 0.927 | 1.000 | 0.927 |
| Mean | 0.899 | 1.000 | 0.899 |
| S.D. | 0.185 | 0.000 | 0.185 |
| Panel C: Total assets 100–200m | | | |
| 1999 | | | |
| 2000 | 0.678 | 1.000 | 0.678 |
| 2001 | 0.626 | 1.000 | 0.626 |
| 2002 | 0.739 | 1.000 | 0.739 |
| 2003 | 0.744 | 1.000 | 0.744 |
| 2004 | 0.848 | 1.000 | 0.848 |
| 2005 | 0.802 | 0.895 | 0.906 |
| 2006 | 0.867 | 0.933 | 0.925 |
| 2007 | 0.751 | 0.967 | 0.778 |
| Mean | 0.757 | 0.974 | 0.781 |
| S.D. | 0.081 | 0.040 | 0.106 |
| Panel D: Total assets 50–100m | | | |
| 1999 | 0.909 | 1.000 | 0.909 |
| 2000 | 0.634 | 0.972 | 0.644 |
| 2001 | 0.548 | 1.000 | 0.548 |
| 2002 | 0.466 | 1.000 | 0.466 |
| 2003 | 0.632 | 1.000 | 0.632 |
| 2004 | 0.918 | 1.000 | 0.918 |
| 2005 | 0.875 | 0.875 | 1.000 |
| 2006 | 1.000 | 1.000 | 1.000 |
| 2007 | 1.000 | 1.000 | 1.000 |
| Mean | 0.776 | 0.983 | 0.791 |
| S.D. | 0.205 | 0.042 | 0.216 |
| Panel E: Total assets 10–50m | | | |
| 1999 | 0.920 | 0.961 | 0.956 |
| 2000 | 0.552 | 0.843 | 0.662 |
| 2001 | 0.545 | 0.939 | 0.579 |
| 2002 | 0.707 | 0.902 | 0.782 |
| 2003 | 0.767 | 0.938 | 0.817 |
| 2004 | 0.869 | 0.926 | 0.938 |
| 2005 | 0.879 | 0.911 | 0.962 |
| 2006 | 0.902 | 0.949 | 0.953 |
| 2007 | 0.950 | 0.960 | 0.990 |
| Mean | 0.788 | 0.925 | 0.849 |
| S.D. | 0.155 | 0.037 | 0.148 |

Table 4 (*Continued*)

| Indices | | | |
|---|---|---|---|
| Banks | Technical efficiency (TE) | Pure technical efficiency (PTE) | Scale efficiency (SE) |
| Panel F: Total assets >10m | | | |
| 1999 | 0.759 | 0.840 | 0.903 |
| 2000 | 0.751 | 0.878 | 0.839 |
| 2001 | 0.777 | 0.825 | 0.935 |
| 2002 | 0.770 | 0.830 | 0.924 |
| 2003 | 0.787 | 0.857 | 0.926 |
| 2004 | 0.851 | 0.905 | 0.937 |
| 2005 | 0.936 | 0.946 | 0.988 |
| 2006 | 0.948 | 0.972 | 0.976 |
| 2007 | 0.954 | 0.983 | 0.970 |
| Mean | 0.837 | 0.893 | 0.933 |
| S.D. | 0.087 | 0.061 | 0.045 |

*Note*: The table presents the technical efficiency (TE) of the Indonesian banking sector and its mutually exhaustive components of pure technical efficiency (PTE) and scale efficiency (SE) mean and standard deviation. Panels A, B, C, D, E, and F shows the mean and standard deviation of TE, PTE, and SE for all banks (Panel A), banks with total assets of <200m (Panel B), banks with total assets between 100m and 200m (Panel C), banks with total assets between 50m and 100m (Panel D), banks with total assets between 10m and 50m (Panel E), and banks with total assets >10m (Panel F) respectively for the years 1999–2008. The TE, PTE, and SE scores are bounded between 0 and 1. Detailed results are available from the authors upon request.

than optimum size or diseconomies of scale (i.e., decreasing returns to scale (DRS)) due to being at more than the optimum size. Thus, decreasing or increasing the scale of production could result in cost savings or efficiencies. It is also worth highlighting that scale inefficiency due to IRS may be attributed to the small banks, whereas scale inefficiency due to DRS tends to be related to the large banks (Miller and Noulas, 1996; Noulas et al., 1990). The empirical findings from this study clearly indicate that size alone is not a sufficient condition to guarantee increased efficiency in terms of economies of scale.

### 4.2. The determinants of Indonesian banks' efficiency

The regression results focusing on the relationship between bank efficiency and the explanatory variables are presented in Tables 5 and 6. Several general comments regarding the test results are warranted. The model performs reasonably well in at least two respects. For one, results for most variables remain stable across the various regressions tested. Second, the empirical findings suggest that all the explanatory variables have the expected signs and, in most cases, are significantly different from zero. The explanatory power of the models is reasonably high, and the *F*-statistic is statistically significant at the 1% level in all cases. It is worth noting that in regression models 2 through 5, when we add the other group of variables to the baseline specification that includes the bank specific attribute variables, the coefficients of the baseline variables continued to remain robust in terms of directions and significance levels. Therefore, we will only discuss the results of the new variables added to the baseline specification.

Referring to the impact of liquidity, LOANS/TA is negatively related to the efficiency of Indonesian banks, indicating a negative relationship between bank efficiency and the level of liquid assets held by the bank. As higher figures of the ratio denote lower liquidity, the results imply that the relatively less (more) liquid banks tend to exhibit higher (lower) efficiency levels. Concerning the impact of bank size, the coefficient of LNTA is positive (statistically significant at the 1% level in the FEM baseline regression), a fact that supports the results of Kosmidou (2008), among others. Hauner (2005) offers two potential explanations for which size could have a positive impact on bank efficiency. First, if it relates to market power, large banks should pay less for their inputs. Second, there may be increasing returns to scale through the allocation of fixed costs (e.g., research or risk management) over a higher volume of services, or efficiency gains from a specialized workforce. However, it is worth noting that the variable loses its explanatory power when we control for other external factors.

As expected, the coefficient of the LLP/TL variable is consistently negative in the OLS and FEM regression models, suggesting that banks with higher credit risk tend to exhibit lower efficiency levels. The results imply that Indonesian banks should focus more on credit risk management, which has been proven to be problematic in the recent past. Serious banking problems have arisen from the failure of financial institutions to recognize impaired assets and then create reserves to write off these assets. An immense help towards smoothing these anomalies would be provided by improving the transparency of the banking sector, which, in turn, will assist banks in evaluating credit risk more effectively and avoiding problems associated with hazardous exposure.

It can be observed from column 1 of Tables 5 and 6 that the coefficient of the NII/TA variable is positive, thus implying that Indonesian banks that derived a higher proportion of their income from non-interest sources, such as fee-based services, tend to report higher efficiency levels. The empirical findings provide support to earlier studies by, among others, Canals (1993). Briefly, Canals (1993) suggests that revenues generated from new business units have significantly contributed to the improvement in bank performance. However, the findings must be interpreted with caution as the variable loses its explanatory power when we control for the macroeconomics and financial market conditions.

Table 5
Panel OLS regression results.

| Explanatory variables | OLS | | | | |
|---|---|---|---|---|---|
| CONSTANT | −1.963 | −1.877 | −4.057* | −14.146*** | −5.128** |
| | (−0.873) | (−0.886) | (−1.851) | (−3.788) | (−1.938) |
| Bank characteristics | | | | | |
| LN (LOANS/TA) | 0.192*** | 0.093*** | 0.094*** | 0.091*** | 0.091*** |
| | (4.710) | (3.797) | (3.698) | (3.675) | (3.789) |
| LN (TA) | 0.012 | −0.005 | −0.006 | −0.007 | −0.005 |
| | (1.280) | (−0.591) | (−0.697) | (−0.802) | (−0.630) |
| LN (LLP/TL) | −0.065 | −0.042 | −0.036 | −0.033 | −0.040 |
| | (−0.984) | (−0.755) | (−0.637) | (−0.548) | (−0.713) |
| LN (NII/TA) | 0.012 | −0.010 | −0.019 | −0.026 | −0.013 |
| | (0.505) | (−0.320) | (−0.573) | (−0.782) | (−0.401) |
| LN (NIE/TA) | −0.218*** | −0.263*** | −0.257*** | −0.254*** | −0.263*** |
| | (−3.457) | (−4.012) | (−4.081) | (−4.117) | (−4.062) |
| LN (EQASS) | 0.215 | 0.259 | 0.225 | 0.207 | 0.254 |
| | (1.023) | (1.391) | (1.217) | (1.083) | (1.346) |
| LN (ROA) | −0.154 | −0.405 | −0.303 | −0.241 | −0.389 |
| | (−0.223) | (−0.738) | (−0.554) | (−0.422) | (−0.697) |
| Macroeconomic conditions | | | | | |
| LN (GDP) | | 0.388*** | 0.930*** | 0.971*** | −0.042 |
| | | (3.503) | (3.506) | (6.811) | (−0.174) |
| LN (INFL) | | −0.107* | −0.299** | −0.219** | −0.111* |
| | | (−1.645) | (−1.947) | (−2.283) | (−1.661) |
| LN (CR3) | | −1.528*** | −1.753*** | −1.576*** | −2.088*** |
| | | (−3.775) | (−3.752) | (−4.085) | (−3.324) |
| LN (MKTCAP/GDP) | | 0.721** | −2.343 | −0.285 | 1.146*** |
| | | (2.241) | (−1.584) | (−1.119) | (2.780) |
| LN (Z-SCORE) | | −0.040** | 0.022 | −0.094*** | −0.050*** |
| | | (−2.328) | (0.878) | (−4.474) | (−2.681) |
| Globalization | | | | | |
| Economic globalization | | | | | |
| ACT_FLOW | | | 0.028** | | |
| | | | (1.910) | | |
| RESTRICT | | | −0.026** | | |
| | | | (−2.275) | | |
| Social globalization | | | | | |
| PERS_CONT | | | | 0.131*** | |
| | | | | (2.725) | |
| INFO_FLOW | | | | −0.020*** | |
| | | | | (−2.699) | |
| CUL_PROX | | | | 0.260*** | |
| | | | | (3.203) | |
| Political globalization | | | | | |
| POLITICS | | | | | 0.071* |
| | | | | | (1.880) |
| $R^2$ | 0.176 | 0.417 | 0.424 | 0.431 | 0.421 |
| Adj. $R^2$ | 0.151 | 0.387 | 0.388 | 0.394 | 0.388 |
| $F$-statistic | 7.164*** | 13.712*** | 11.970*** | 11.482*** | 12.799*** |
| No. of observations | 243 | 243 | 243 | 243 | 243 |

The notation used in the table below is defined as follows: LOANS/TA is used as a proxy measure of loans intensity, calculated as total loans divided by total assets; TA is a proxy measure of size, calculated as total bank assets; LLP/TL is a measure of bank risk calculated as the ratio of total loan loss provisions divided by total loans; NII/TA is a measure of bank diversification towards non interest income, calculated as total non-interest income divided by total assets; NIE/TA is a proxy measure for costs, calculated as non-interest expenses divided by total assets; EQASS is a measure of capitalization, calculated as book value of shareholders equity as a fraction of total assets; ROA is a proxy measure of profitability computed as profit after divided by total assets; GDP is the gross domestic products; INFL is the rate of inflation; CR3 is the three largest banks asset concentration ratio; MKTCAP/GDP is the ratio of stock market capitalization; Z-SCORE is used as a proxy measure of the banking sector's risk to default; ACT_FLOW is the actual flows index; RESTRICT is the restrictions index; PERS_CONT is the personal contact index; INFO_FLOW is the information flows index; CUL_PROX is the cultural proximity index; POLITICS is the political globalization index.
Values in parentheses are $t$-statistics.
* Significance at 10% level.
** Significance at 5% level.
*** Significance at 1% level.

Table 6
Panel fixed effects regression results.

| Explanatory variables | FEM | | | | |
|---|---|---|---|---|---|
| CONSTANT | −1.840 | −1.295 | −3.329** | −14.128*** | −5.045** |
| | (−1.225) | (−0.970) | (−1.944) | (−5.901) | (−2.264) |
| Bank characteristics | | | | | |
| LN (LOANS/TA) | 0.136*** | 0.014 | 0.018 | 0.012 | 0.008 |
| | (4.052) | (0.260) | (0.339) | (0.213) | (0.156) |
| LN (TA) | 0.126*** | −0.065 | −0.064 | −0.072 | −0.069 |
| | (4.376) | (−0.941) | (−0.914) | (−1.010) | (−0.991) |
| LN (LLP/TL) | −0.044 | −0.014 | −0.007 | −0.001 | −0.012 |
| | (−0.751) | (−0.302) | (−0.141) | (−0.027) | (−0.254) |
| LN (NII/TA) | 0.023* | −0.013 | −0.022 | −0.031 | −0.017 |
| | (1.758) | (−0.553) | (−0.919) | (−1.386) | (−0.711) |
| LN (NIE/TA) | −0.129 | −0.278*** | −0.267*** | −0.268*** | −0.283*** |
| | (−1.513) | (−3.498) | (−3.439) | (−3.495) | (−3.635) |
| LN (EQASS) | 0.199 | 0.275** | 0.229** | 0.204* | 0.272** |
| | (1.479) | (2.416) | (2.106) | (1.810) | (2.261) |
| LN (ROA) | −0.287 | −0.551 | −0.417 | −0.339 | −0.543 |
| | (−0.636) | (−1.681) | (−1.405) | (−1.081) | (−1.585) |
| Macroeconomic conditions | | | | | |
| LN (GDP) | | 0.495** | 0.982*** | 1.075*** | 0.004 |
| | | (2.476) | (4.329) | (12.393) | (0.014) |
| LN (INFL) | | −0.097 | −0.270** | −0.207*** | −0.101* |
| | | (−1.572) | (−2.016) | (−2.696) | (−1.659) |
| LN (CR3) | | −1.409*** | −1.638*** | −1.457*** | −2.066*** |
| | | (−4.252) | (−3.826) | (−4.739) | (−4.506) |
| LN (MKTCAP/GDP) | | 0.522 | −2.195* | −0.363*** | 1.007** |
| | | (1.285) | (−1.692) | (−2.774) | (2.528) |
| LN (Z-SCORE) | | −0.036** | 0.020 | −0.095*** | −0.048*** |
| | | (−1.990) | (0.985) | (−7.107) | (−2.637) |
| Globalization | | | | | |
| Economic globalization | | | | | |
| ACT_FLOW | | | 0.025** | | |
| | | | (1.940) | | |
| RESTRICT | | | −0.024** | | |
| | | | (−2.343) | | |
| Social globalization | | | | | |
| PERS_CONT | | | | 0.126*** | |
| | | | | (3.833) | |
| INFO_FLOW | | | | −0.020** | |
| | | | | (−2.486) | |
| CUL_PROX | | | | 0.278*** | |
| | | | | (6.211) | |
| Political globalization | | | | | |
| POLITICS | | | | | 0.082** |
| | | | | | (2.598) |
| $R^2$ | 0.469 | 0.612 | 0.617 | 0.626 | 0.617 |
| Adj. $R^2$ | 0.367 | 0.526 | 0.528 | 0.536 | 0.530 |
| $F$-statistic | 4.604*** | 7.104*** | 6.875*** | 6.958*** | 7.059*** |
| No. of observations | 243 | 243 | 243 | 243 | 243 |

The notation used in the table below is defined as follows: LOANS/TA is used as a proxy measure of loans intensity, calculated as total loans divided by total assets; TA is a proxy measure of size, calculated as total bank assets; LLP/TL is a measure of bank risk calculated as the ratio of total loan loss provisions divided by total loans; NII/TA is a measure of bank diversification towards non interest income, calculated as total non-interest income divided by total assets; NIE/TA is a proxy measure for costs, calculated as non-interest expenses divided by total assets; EQASS is a measure of capitalization, calculated as book value of shareholders equity as a fraction of total assets; ROA is a proxy measure of profitability computed as profit after divided by total assets; GDP is the gross domestic products; INFL is the rate of inflation; CR3 is the three largest banks asset concentration ratio; MKTCAP/GDP is the ratio of stock market capitalization; Z-Score is used as a proxy measure of the banking sector's risk to default; ACT_FLOW is the actual flows index; RESTRICT is the restrictions index; PERS_CONT is the personal contact index; INFO_FLOW is the information flows index; CUL_PROX is the cultural proximity index; POLITICS is the political globalization index.
Values in parentheses are $t$-statistics.
* Significance at 10% level.
** Significance at 5% level.
*** Significance at 1% level.

During the period under study, the empirical findings seem to suggest that operating expenses as measured by NIE/TA consistently exhibit a negative relationship with bank efficiency. The finding is in consonance with the *bad management* hypothesis of Berger and DeYoung (1997). A low degree of efficiency is a signal of poor senior management practices, which include input-usage and day-to-day operations. Clearly, efficient cost management is a prerequisite for improving the efficiency of the Indonesian banking sector.

Referring to the impact of capitalization, the empirical findings clearly indicate that the coefficient of the EQASS variable is always positive and is statistically significant when we control for macroeconomic and financial market conditions and other globalization measures in the FEM regression models. The result is consistent with previous studies by, among others, Isik and Hassan (2003), Staikouras and Wood (2004), Goddard et al. (2004), Pasiouras and Kosmidou (2007), and Kosmidou (2008) as it provides support to the argument that well capitalized banks face lower costs of going bankrupt and lower their cost of funding, which, thereby results in higher efficiency levels. Nevertheless, strong capital structure is essential for banks in emerging economies as it provides additional strength to withstand financial crises and increased safety for depositors during unstable macroeconomic conditions.

The results regarding the impact of macroeconomic conditions on the efficiency of the Indonesian banking sector are mixed. It is apparent from Tables 5 and 6 that the coefficient of the LNGDP variable entered most of the regression models with a positive sign (statistically significant at the 5% level or better), thus supporting the argument of the association between economic growth and the performance of the banking sector. Because the demand for financial services tends to grow as economies expand and societies become wealthier, the robust economic growth during the period under study could have boosted the demand for financial services and improved the quality of loans. On the other hand, the empirical findings seem to suggest that the impact of inflation is negative, thus implying that during the period under study, the levels of inflation have been unanticipated by the Indonesian banks. This does not allow bank managements the opportunity to adjust the interest rates accordingly and to earn lower interest margins as a consequence.

Concerning the impact of concentration in the banking sector, it can be observed from Tables 5 and 6 that the coefficient of the CR3 is always negative and is statistically significant at the 1% level in all regression models. If anything could be delved further, the empirical findings clearly reject the structure-conduct-performance (SCP) hypothesis. To recap, the SCP hypothesis states that banks in highly concentrated markets tend to collude and, as a consequence, earn monopoly profits (Short, 1979; Gilbert, 1984; Molyneux et al., 1996). The impact of stock market capitalization (MKTCAP/GDP) on the efficiency of Indonesian banks is positive, implying that during the period under study the Indonesian stock market acts as a complement, rather than substitute to potential borrowers. However, it is interesting to note that the coefficient of the variable becomes negative when we control for measures of *economic* and *social globalization* (statistically significant at the 10% and 1% levels, respectively).

As expected, the coefficient of the Z-SCORE variable entered most of the regression models with a negative sign, which is in consonance with the finding of, among others, Boyd and De Nicolo (2006). If anything could be further investigated, the empirical findings from this study lend support to the stringent capital requirements of Basel II. From the policymaking perspective, the findings seem to call for a more effective policymaker role in reducing excessive bank risk exposures and at the same time to induce a more efficient risk management by banks.

### *4.3. Does greater economic globalization foster bank efficiency?*

To address the issue whether globalization matters for the efficiency of the Indonesian banking sector, we re-estimate Eq. (3) to include the three different dimensions of globalization, namely, *economic globalization*, *social globalization*, and *political globalization*. The relationships between the three different dimensions of globalization and Indonesian bank efficiency are analyzed individually because of the high correlation between the sub-indices (see Dreher, 2006). First, to measure the impact of *economic globalization* on the efficiency of the Indonesian banking sector, two different measures are introduced in regression model 3, namely, *actual flow* (ACT_FLOW) and *restrictions* (RESTRICT).

Column 3 of Tables 5 and 6 reports the results for the *economic globalization* sub-indices. As seen, higher economic integration (ACT_FLOW) is positively and significantly associated with higher bank efficiency. On the other hand, restrictions on trade and capital (RESTRICT) seem to have a negative influence on the efficiency of banks operating in the Indonesian banking sector. The significant coefficient of the RESTRICT variable signifies the benefits of capital account liberalization. Among others, developing countries such as Indonesia could potentially gain from foreign capital inflows into the financial sector. As capital account liberalization is usually accompanied by liberalization of the financial services sector, competition in the financial services sector will intensify, thus eroding monopolistic profits and, subsequently, driving down franchise values of domestic financial institutions.

The intensity of competition in the banking sector may also force the domestic banks to become more efficient, stimulate innovation, and improve productivity. Moreover, efficiency gains can also be achieved through spillovers or international transfers of technology and efficient allocation of resources through financial deepening (development of financial instruments, direct and indirect financing, and more activities in the banking sector and stock markets). Exposure to higher standards in accounting, auditing, regulations on disclosure and operating procedures introduced by the foreign players could also improve the efficiency and productivity of the domestic banks. In a similar vein, lower tariffs could potentially lead to a higher trade volume and promote foreign investment (Dreher, 2006).

Mayer-Schoenberger and Hurley (2000) note that global communication networks significantly reduced cross-border

transactions costs and promote international trade and economic integration. Furthermore, information can be accessed easily, thus resulting in the importance of geographic proximity to decline (Dreher, 2006). Within the context of a developing country banking sector, the earlier studies by, among others, Sufian (2009) suggest that the weight of proximity is greater for foreign banks headquartered in distant countries. Furthermore, the "*liability of unfamiliarity*" could be more difficult to overcome due to the difference in market environments, languages, cultures, supervisory, and/or regulatory structures (Sufian, 2009).

To address this concern, three measures of *social globalization* are introduced in regression model 4, namely, *personal contacts* (PERS_CON), *information flows* (INFO_FLOW), and *cultural proximity* (CUL_PROX). As it turns out, *personal contacts* (PERS_CON) and *cultural proximity* (CUL_PROX) seem to have positive and significant influence on the efficiency of banks operating in the Indonesian banking sector (column 4 of Tables 5 and 6). If anything could be delved further, the empirical findings clearly suggest that greater social integration significantly promotes the efficiency of Indonesian banks. On the other hand, it can be observed from column 4 of Tables 5 and 6 that the coefficient of the information flow index (INFO_FLOW) is negative in both the OLS and the FEM regression models (statistically significant at the 1% and 5%, respectively).

Finally, column 5 of Tables 5 and 6 reports the results for political dimension. It can be observed that the coefficient of the POLITICS variable has a positive and significant impact on the efficiency of Indonesian banks. Dreher (2006) notes that economic growth could be influenced by political integration and that high political integration could lead to reforms in political or economic processes and, thus, promote growth (Dreher, 2006). Within the context of the ASEAN economies, the examples could be free trade zones areas such as the ASEAN Free Trade Area (AFTA), ASEAN-Japan Comprehensive Economic Partnership (AJCEP), ASEAN-Australia-New Zealand Free Trade Area (AANZFTA), ASEAN-China Free Trade Area (ACFTA), ASEAN-India Free Trade Area (AIFTA), ASEAN-Korea Free Trade Area (AKFTA), etc.

### 4.4. Robustness checks

To check for the robustness of the results, we performed a number of sensitivity analyses. First, we restrict our sample to banks with more than three years of observations. All in all, the results remain qualitatively similar in terms of directions and significance levels. Second, we address the effects of outliers in the sample by excluding the top and bottom 1% of the sample. The results continued to remain robust in terms of directions and significance levels. To conserve space, we do not report the regression results in the paper; however, they are available upon request.

## 5. Concluding remarks

The paper provides new empirical evidence on the impact of economic globalization on bank efficiency in a developing economy. By employing the Data Envelopment Analysis (DEA) method, we compute the efficiency of the Indonesian banking sector during the post-Asian financial crisis period of 1999–2007. The empirical findings suggest that the inefficiency of the Indonesian banking sector stems largely from scale rather than from pure technical issues. We find that the relatively better capitalized banks with lower liquidity levels exhibit higher levels of efficiency, while banks with high credit risk and overhead expenses tend to be relatively inefficient in their intermediation function. The result about the impact of the GDP growth provides support for the argument of positive association between economic growth and financial sector performance.

Examining different components of economic globalization, we find that not all these components are equally regressive on bank efficiency. We find that several dimensions of the economic globalization have a significant (positive) influence on bank efficiency, namely, actual flows, personal contact, cultural proximity, and political globalization. On the other hand, greater trade and capital account restrictions inhibit the efficiency of banks operating in the Indonesian banking sector.

Research on economic globalization and its relationship with the financial sector is still in its infancy. Therefore, much more remains to be done. Refined statistical tests, further development of the economic globalization index (both the weights and the composition), continued analysis of which components of the economic globalization index are important studies of what determines the scope of economic globalization (which implies a need for further studies of political institutions and incentives), studies of more variables that economic globalization can be expected to affect, and a continuing development of economic theory that puts the role of institutions and politics at the center of the analysis remain, in large part, still to be conducted.

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## Appendix A.

| Indices and variables | Definitions | Weight (%) |
|---|---|---|
| Economic globalization | | 37 |
| (i) Actual flows | | 50 |
| (a) Trade (% of GDP) | Trade is the sum of exports and imports of goods and services measured as a share of GDP. | 19 |
| (b) Foreign Direct Investment, flows (% of GDP) | Gross FDI is the sum of the absolute values of inflows and outflows of FDI recorded in the balance of payments financial account. It includes equity capital, reinvestment of earnings, other long-term capital, and short-term capital. | 20 |
| (c) Foreign Direct Investment, stocks (% of GDP) | Sum of inward and outward FDI stock as a percentage of GDP. | 24 |
| (d) Portfolio Investment (% of GDP) | Portfolio investment is the sum of portfolio investment assets stocks and portfolio investment liabilities stocks. | 17 |
| (e) Income Payments to Foreign Nationals (% of GDP) | Income payments refer to employee compensation paid to nonresident workers and investment income (payments on direct investment, portfolio investment, and other investments). Income derived from the use of intangible assets is excluded. | 20 |
| (ii) Restrictions | | 50 |
| (a) Hidden Import Barriers | The index is based on the Global Competitiveness Report's survey question: "In your country, tariff and non-tariff barriers significantly reduce the ability of imported goods to compete in the domestic market." | 22 |
| (b) Mean Tariff Rate | As the mean tariff rate increases, countries are assigned lower ratings. The rating declines toward zero as the mean tariff rate approaches 50%. | 28 |
| (c) Taxes on International Trade (% of current revenue) | Taxes on international trade include import duties, export duties, profits of export or import monopolies, exchange profits, and exchange taxes. Current revenue includes all revenue from taxes and non-repayable receipts (other than grants) from the sale of land, intangible assets, government stocks, or fixed capital assets, or from capital transfers from nongovernmental sources. It also includes fines, fees, recoveries, inheritance taxes, and non-recurrent levies on capital. | 27 |
| (d) Capital Account Restrictions | The index is based on two components: (i) Beginning with the year 2002, this subcomponent is based on the question: "Foreign ownership of companies in your country is (1) rare, limited to minority stakes, and often prohibited in key sectors or (2) prevalent and encouraged". For earlier years, this sub-component was based on two questions about "Access of citizens to foreign capital markets and foreign access to domestic capital markets". (ii) Index based on the IMF's Annual Report on Exchange Arrangements and Exchange Restrictions, including 13 different types of capital controls. It is constructed by subtracting the number of restriction from 13 and multiplying the result by 10. | 22 |
| Social globalization | | 39 |
| (i) Personal contact | | 33 |
| (a) Telephone Traffic (minutes per person) | International voice traffic is the sum of international incoming and outgoing telephone traffic. | 26 |
| (b) Transfers (% of GDP) | Sum of gross inflows and gross outflows of goods, services, income, or financial items without a quid pro quo. | 3 |
| (c) International Tourism | Sum of arrivals and departures of international tourists as a share of population. | 26 |
| (d) Foreign Population (% of total population) | Foreign population is the number of foreign or foreign-born residents in a country. | 20 |
| (e) International Letters (per capita) | Number of international letters sent and received per capita. | 25 |
| (ii) Information flows | | 36 |
| (a) Internet Users (per 1000 people) | Internet users are people with access to the worldwide internet network. | 36 |
| (b) Television (per 1000 people) | Share of households with a television set. | 36 |
| (c) Trade in Newspapers (% of GDP) | The sum of exports and imports in newspapers and periodicals in percent of GDP. Data are provided by the Statistical Division of the United Nations and correspond to those published in the U.N. World Trade Annual. | 28 |
| (iii) Cultural proximity | | 31 |
| (a) Number of McDonalds Restaurant (per capita) | Number of McDonald's Restaurants per capita. | 43 |
| (b) Number of Ikea (per capita) | Number of Ikea outlets per capita. | 44 |
| (c) Trade in Books (% of GDP) | The sum of exports and imports in books and pamphlets in percent of GDP. Data are provided by the Statistical Division of the United Nations and correspond to those published in the U.N. World Trade Annual. | 12 |
| Political globalization | | 25 |
| (a) Embassies in Country | Absolute number of embassies in a country. | 25 |
| (b) Membership in International Organizations | Absolute number of international inter-governmental organizations. | 28 |
| (c) Participation in U.N. Security Council Missions | Personnel contributed to U.N. Security Council Missions per capita. | 22 |
| (d) International Treaties | Any document signed between two or more states and ratified by the highest legislative body of each country since 1945. Not ratified treaties, or subsequent actions, and annexes are not included. Treaties signed and ratified must be deposited in the Office of Secretary General of the United Nations to be included. | 25 |

*Source*: Dreher (2006) and Dreher et al. (2008b).

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